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(54) **TONER CARTRIDGE AND METHOD FOR REDUCING IMAGE ARTIFACT**

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(52) **U.S. Cl.**
CPC ***G03G 15/0894*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 2215/00987; G03G 15/0894
See application file for complete search history.

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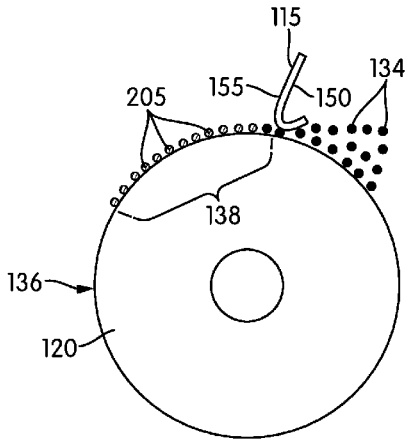
(57) **ABSTRACT**

A method of reducing an image artifact in a remanufactured toner cartridge. The method includes operating the remanufactured toner cartridge to transfer toner to a position between a developer roller and a metering blade of the remanufactured toner cartridge, the toner having a first formulation; and positioning a material having a second formulation different from the first formulation between the developer roller and the metering blade.

20 Claims, 4 Drawing Sheets



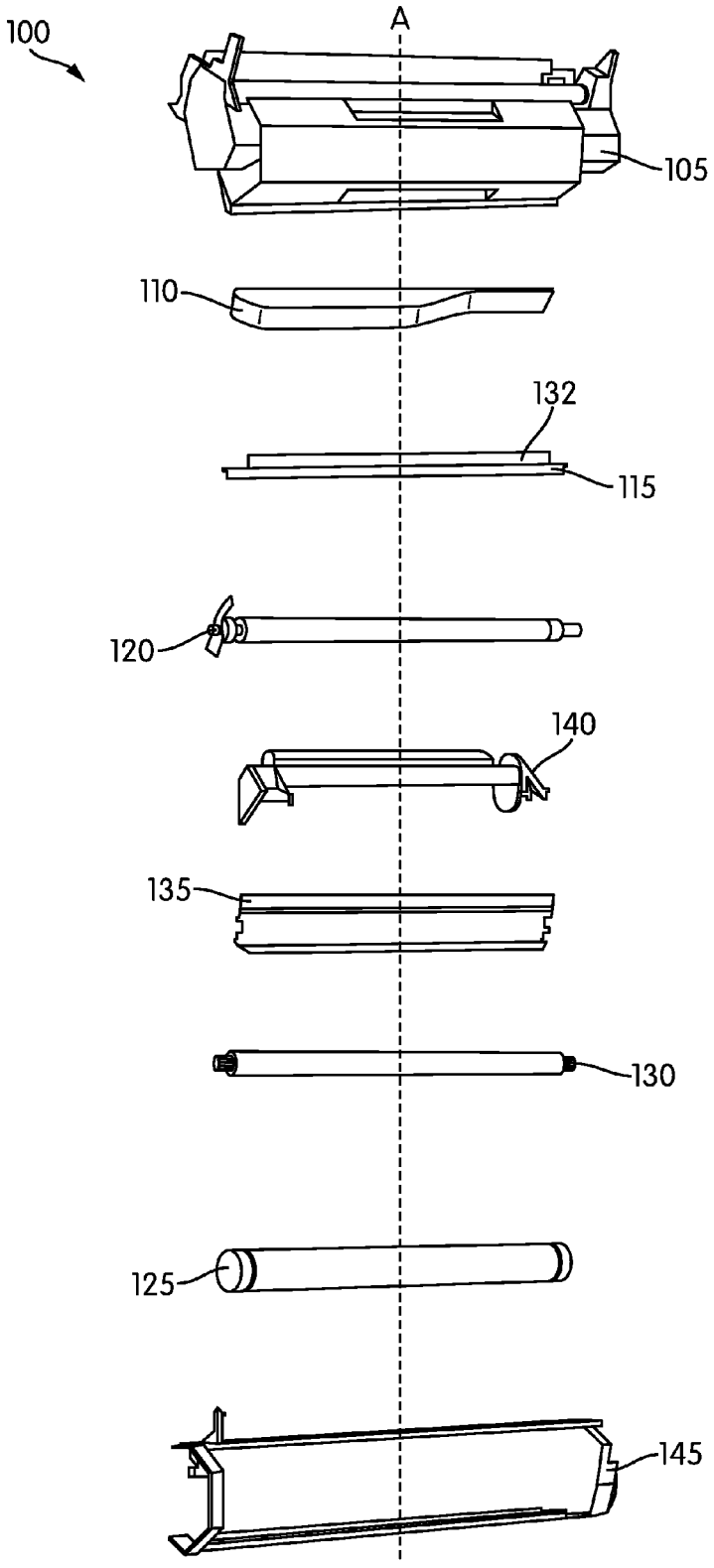


FIG. 1

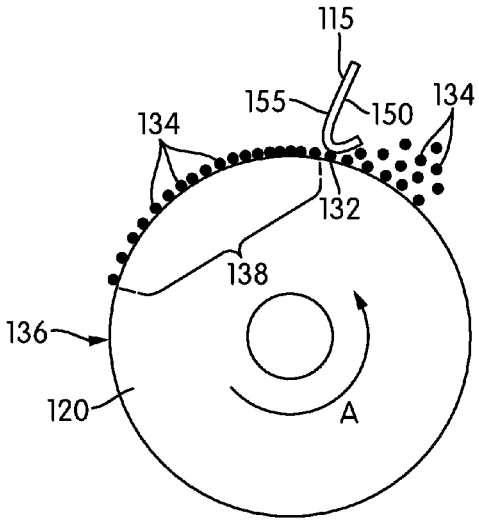


FIG. 2

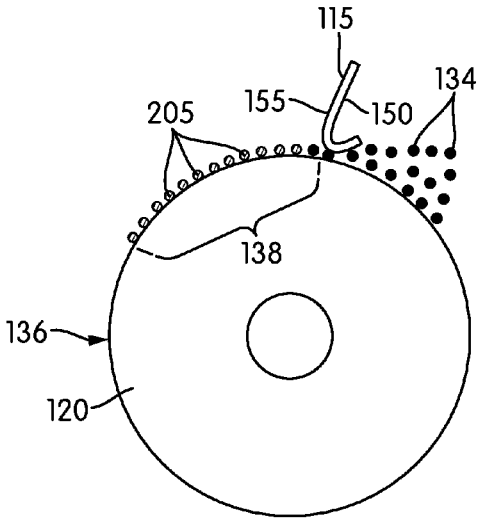


FIG. 3

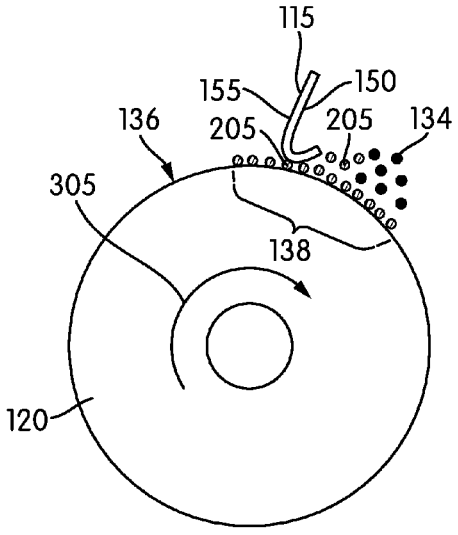


FIG. 4

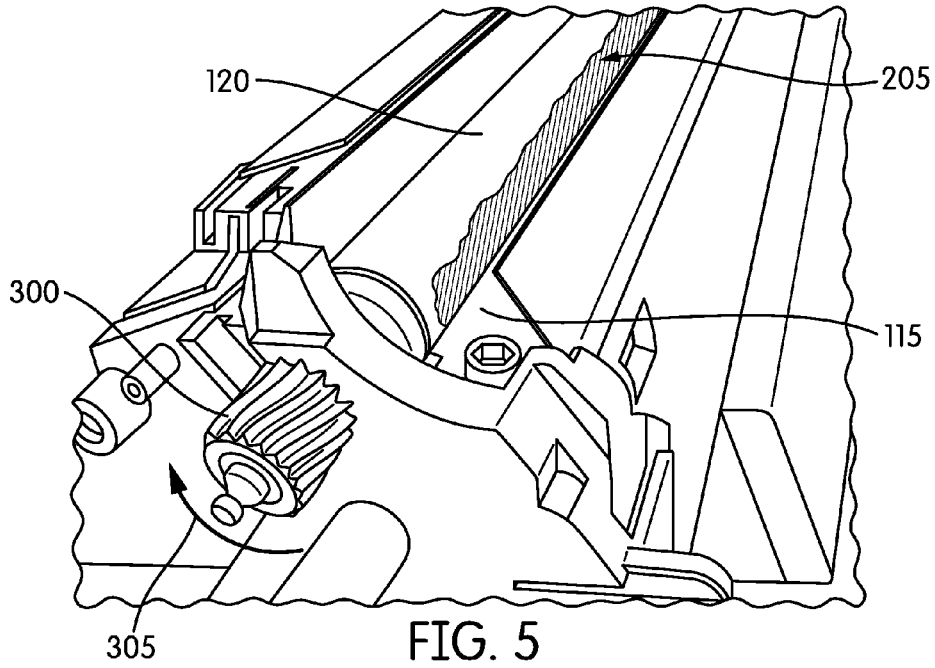


FIG. 5

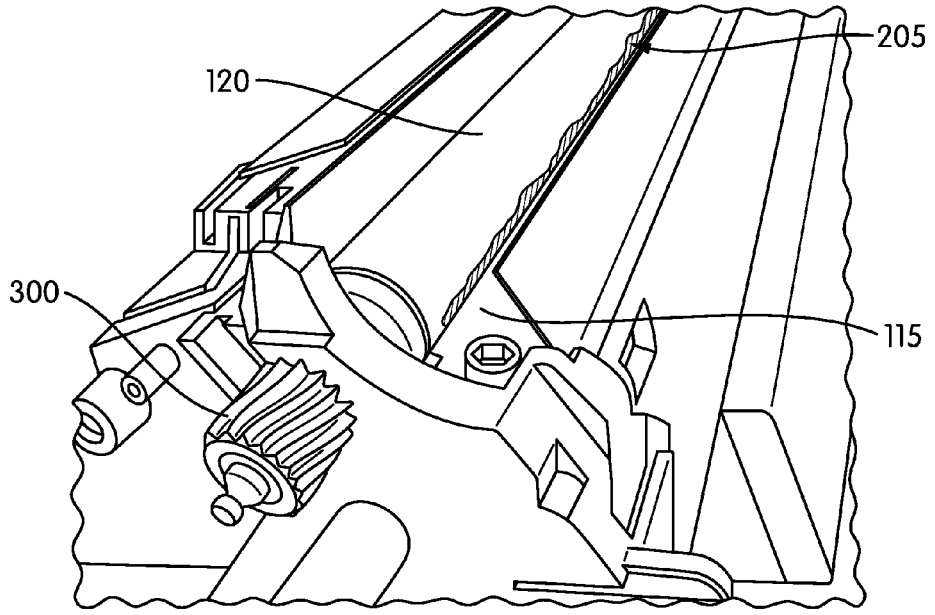


FIG. 6

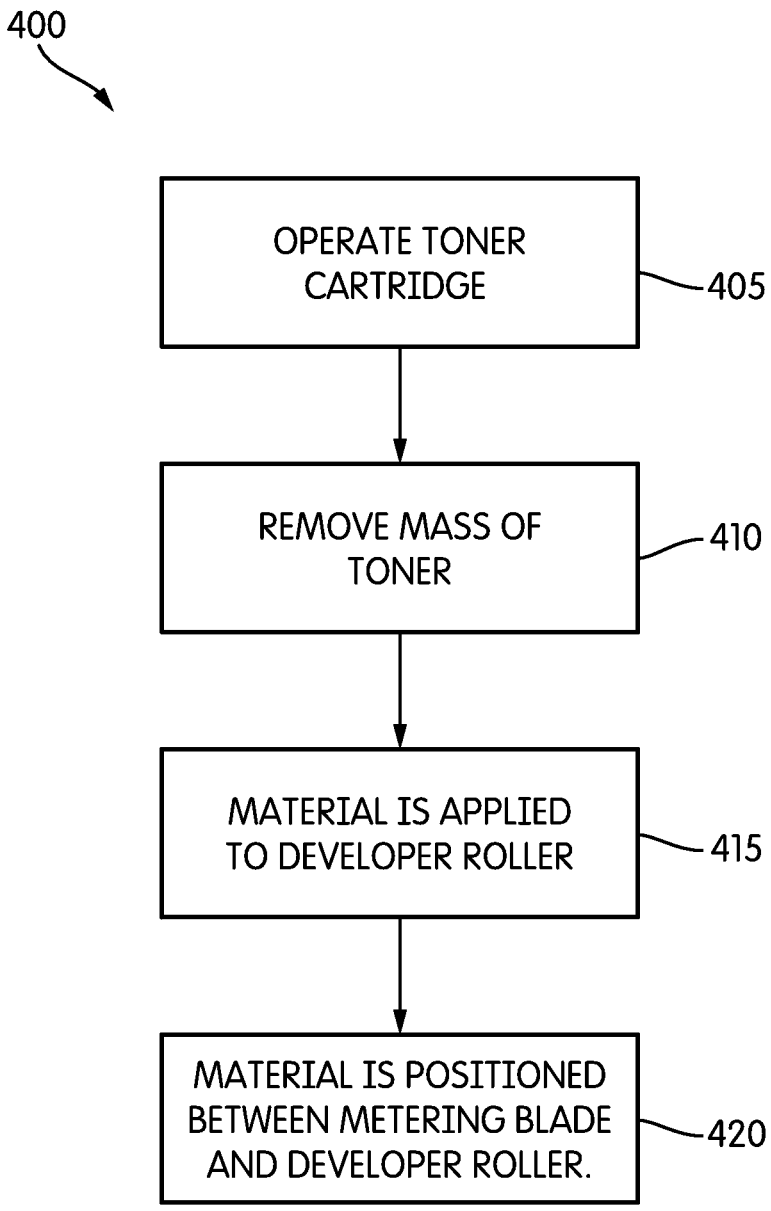

400
OPERATE TONER CARTRIDGE
405
REMOVE MASS OF TONER
410
MATERIAL IS APPLIED TO DEVELOPER ROLLER
415
MATERIAL IS POSITIONED BETWEEN METERING BLADE AND DEVELOPER ROLLER.
420

FIG. 7

TONER CARTRIDGE AND METHOD FOR REDUCING IMAGE ARTIFACT

TECHNICAL FIELD

The invention generally relates to remanufactured printer cartridges, such as toner cartridges, and a method of remanufacturing printer cartridges.

BACKGROUND

Printing systems, such as high volume printing devices (e.g., network printers, photocopiers, etc.) typically use toner cartridges which store and transmit toner to an intended medium, such as paper. Once the toner has depleted, the used toner cartridge is removed from the printing system, and typically disposed of Remanufacturing of used toner cartridges permits the toner cartridges to be reused rather than disposed of in landfills.

Toner cartridges come in a variety of configurations. Although specific constructions vary among manufacturers and printers, many toner cartridges include components such as a toner hopper, a variety of toner-regulating blades, a developer roller, a primary charge roller, and an organic photo-conductor drum.

To avoid discarding useful materials and to thereby reduce the environmental impact of printing operations, many toner cartridges may be remanufactured. Remanufacturing involves collecting used toner cartridges that, prior to their use, were brand new cartridges typically supplied by the manufacturer of the printer with which the cartridges are compatible. These cartridges are often referred to in the art as "OEM cartridges" because they are supplied by the original equipment manufacturer, i.e., the manufacturer of the printer and the compatible printer cartridge.

Remanufacturing of toner cartridges typically includes, among other things, disassembling the toner cartridge, cleaning the toner cartridge, refilling the toner hopper with new toner, repairing or replacing worn or damaged components, and reassembling the toner cartridge. In many remanufacturing operations, toner and other components used in the remanufacturing process are sourced from suppliers other than those that supply the components of the OEM cartridge. Thus, a remanufactured cartridge is often a mix of previously used OEM cartridge components and new aftermarket components. As a result, when developing a remanufactured cartridge, substantial trial and error is often required before arriving at a combination of replacement components and toner that interact with the used OEM components in a way that provides acceptable print quality and page volume.

SUMMARY

In one embodiment, the invention provides a remanufactured toner cartridge including a toner hopper; a mass of toner stored within the toner hopper, the toner having a first formulation; a developer roller supported for rotation by the toner hopper, the developer roller having an outer surface and including a portion that faces into the toner hopper for gathering toner from the toner hopper; a metering blade including an edge facing the developer roller, a first side facing into the toner hopper, and a second side facing away from the toner hopper; and a material having a second formulation between the edge of the metering blade and the outer surface of the developer roller, the second formulation different from the first formulation.

In another embodiment the invention provides a method of reducing an image artifact in a remanufactured toner cartridge. The method includes operating the remanufactured toner cartridge to transfer toner to a position between a developer roller and a metering blade of the remanufactured toner cartridge, the toner having a first formulation; and positioning a material having a second formulation different from the first formulation between the developer roller and the metering blade.

Other aspects of the invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an exploded view of a toner cartridge according to one embodiment of the invention.

FIG. **2** illustrates a cross-sectional view taken along A of the assembled toner cartridge of FIG. **1**.

FIG. **3** illustrates a cross-sectional view taken along A of the assembled toner cartridge of FIG. **1**.

FIG. **4** illustrates a cross-sectional view taken along A of the assembled toner cartridge of FIG. **1**.

FIG. **5** illustrates a perspective view of the assembled toner cartridge of FIG. **1**.

FIG. **6** illustrates a perspective view of the assembled toner cartridge of FIG. **1**.

FIG. **7** illustrates a process of for reducing streaks or an image artifact of the toner cartridge of FIG. **1**.

DETAILED DESCRIPTION

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways.

FIG. **1** is an exploded view of a toner cartridge **100**. The toner cartridge **100** is a consumable component used in a printing system (e.g., network printers, laser printers, photocopiers, etc.). The toner cartridge **100** stores and, in cooperation with components of a compatible printer, transfers toner to an intended medium (e.g., paper). Toner typically has a predetermined toner electrical potential, and is therefore attracted to elements or components having a different electrical potential. For example, toner may be attracted to components having a more negative, more positive, or opposite electrical potential relative to the toner electrical potential. Therefore, during printing, the toner can be transmitted via a series of progressively increasing, progressively decreasing, or opposite electrical potentials that "hand off" the toner from component to component.

The toner cartridge **100** includes a toner hopper **105** for storing a mass of toner having a first formulation. In some embodiments, the toner hopper **105** is provided with a seal **110**. The seal **110** prevents toner from spilling prior to installation into the printing system. In some embodiments, the seal **110** is a removable protective strip.

The toner cartridge **100** of the illustrated embodiment is an "all-in-one" cartridge and further includes the following components or elements: a metering blade (e.g., a charge blade or doctor blade) **115**; a developer roller (i.e., a magnetic roller or a developer unit) **120**; an organic photo-conductor (OPC) drum **125**; and a primary charge roller (PCR) **130**. In other embodiments, the toner cartridge **100** may include more

or fewer components. For example, alternative embodiments of the cartridge **100** may be developer cartridges that do not include an OPC drum or a PCR. In such embodiments, the OPC drum and PCR may be part of the printer or may be provided as a separately removable drum unit.

During operation, toner is collected from the toner hopper **105** by the rotating developer roller **120** and electrostatically transferred from the developer roller **120** to the OPC drum **125**. A laser system having a laser beam, located within the printing system, scans an electrostatic image onto the OPC drum **125** with the laser beam. In some printers, the electrostatic image produced by the laser corresponds to the image to be printed. In other printers, the laser forms an electrostatic image that is a negative of the image that is to be printed. Regardless of the specific configuration, toner carried by the developer roller **120** is electrostatically attracted to the electrostatic image produced on the OPC drum **125** by the laser beam. The OPC drum **125** then applies the toner, which is in a pattern corresponding to the desired image, onto the intended medium by direct contact or by further electrostatic transfer. The toner is then fused to the intended medium, typically by way of a heating element (e.g., a fuser).

The toner cartridge **100** further includes a wiper blade **135**. The wiper blade **135** remains in constant contact with the OPC drum **125** and wipes residual toner (i.e., toner remaining on the OPC drum **125** after transfer to the intended medium) from the OPC drum **125**. The wiped residual toner is collected by a waste bin **140**.

In some embodiments, the toner cartridge **100** further includes a drum shutter **145**. The drum shutter **145** protects the OPC drum **125** from physical damage and exposure to light when the toner cartridge **100** is not installed in the printing system.

During remanufacturing, the toner cartridge **100** is disassembled. The components of the disassembled toner cartridge **100** are then cleaned and worn or damaged components are repaired or replaced. The toner hopper **105** is refilled with toner, and the toner cartridge **100** is then reassembled

Often times after remanufacture of the toner cartridge **100**, the toner cartridge **100** is operated one or more times before being sold to the end user. Operation of the toner cartridge **100** may include testing of the toner cartridge **100**, such as but not limited to, post-testing the toner cartridge **100** for quality control purposes. A post-test includes installing the toner cartridge **100** in a printing system and using the printing system, along with the installed toner cartridge **100**, to print one or more test pages in order to confirm proper operation of the remanufactured cartridge **100**.

In some embodiments, the toner hopper **105** is provided with the seal **110** prior to post-testing. In such an embodiment, because the toner hopper **105** is sealed, toner does not transfer from the toner hopper **105** to the developer roller **120** during the post-test. Rather, prior to post-testing, the toner is applied to the developer roller **120**. The toner cartridge **100** is then installed in a printing system and one or more test pages are printed in order to confirm proper operation of the remanufactured cartridge **100**. In such an embodiment, the seal **110** is then removed before operation of the toner cartridge **100** by the end user.

Referring also to FIG. **2** the metering blade **115** includes an edge **132**. The edge **132** is sized and positioned to apply a constant pressure on a narrow band of the developer roller **120** in order to form a uniformly thick layer of toner particles **134** on the developer roller **120**. As toner passes between the edge **132** and the narrow band of the developer roller **120**, a gap between the edge **132** and the developer roller **120** is created (the gap being approximately equal to the thickness of the layer of toner). As the developer roller **120** rotates in the direction of the arrow A, toner passes through the gap between the edge **132** of the metering blade **115** and the developer roller **120** and is arranged into a uniform layer of toner particles **134** on the surface of the developer roller **120** that is "downstream" of the metering blade **115**. It should be appreciated that, for clarity of understanding, the drawings have been simplified to show a layer of toner that is a single toner particle thick. In reality the layer of toner is generally greater than the thickness of an individual toner particle.

FIG. **2** is an example of a condition of the developer roller **120** and metering blade **115** after a post-test operation. The metering blade **115** includes a first side **150** facing toward the toner hopper **105** and a second side **155** facing away from the toner hopper **105**. After operation, an outer surface **136** of the developer roller **120** includes a band **138** that is covered in toner particles **134**. The band **138** is outside the toner hopper **105** and on the second side **155** of the metering blade **115**. Toner particles **134** are also present between the edge **132** of the metering blade **115** and the outer surface **136** of the developer roller **120**. In some circumstances, if these toner particles **134** are maintained between the edge **132** of the metering blade **115** and the developer roller **120**, the toner particles **134** can become strongly attached to the outer surface **136** of the developer roller **120**. These strongly attached toner particles **134** may result in image artifacts, typically in the form of horizontal lines, on pages printed using the toner cartridge **100**. One set of circumstances known to give rise to such image artifacts includes prolonged storage in the presence of high heat and humidity.

Referring also to FIGS. **3** through **5**, to reduce the occurrence of image artifacts, a material **205** having different physical characteristics than the toner particles **134**, e.g., a second formulation, may be placed between the edge **132** of the metering blade **115** and the developer roller **120**. In some embodiments, the material **205** may have a lower affinity or adhesion tendency with respect to the developer roller **120**. Placing the material **205** between the edge **132** of the metering blade **115** and the developer roller **120** may reduce the occurrence of image artifacts associated with toner particles **134** sticking to the developer roller **120**. In the illustrated embodiment, the toner particles **134** between the edge **132** of the metering blade **115** and the developer roller **120** are removed before placement of the material. In other embodiments, the toner particles **134** between the edge **132** of the metering blade **115** and the developer roller **120** are not removed before placement of the material

In some embodiments, the material **205** is a second toner having a substantially yellow color. The second toner may be an original equipment manufacturer toner having a substantially yellow color or another color. In some embodiments, the second toner may be mixed with a cyan, magenta, and/or black toner. In other embodiments, the material **205** includes a fluoroadditive, such as but not limited to, Zonyl® MP 1300. In other embodiments, the material **205** includes a silicone resin, such as but not limited to, a fine particle silicone resin. In some embodiments, the fine particle silicone resin includes a tospearl **3120** silicone resin. In still other embodiments, the material **205** may be a combination of two or more of the above materials. In another embodiment, the material **205** is a thin flexible material, such as but not limited to, ribbon or ribbon-like material that is removed before operation of the toner cartridge **100** by the end user.

With reference to FIGS. **3-5**, following a post-test, toner particles **134** may be removed from the band **138**, for example by wiping, and the material **205** may be applied to the band **138**, for example using a brush or swab. FIGS. **3** and **5**

illustrate the developer roller **120** after the material **205** has been applied to the band **138**. In some embodiments, the material **205** may be applied to the band **138** without the additional step of removing the toner particles **134** because the mere addition of the material **205** is sufficient to reduce print defects. Once the material **205** has been applied to the developer roller **120**, the developer roller **120** is back driven, i.e., rotated in a direction opposite the direction associated with normal operation of the cartridge, to position the material **205** between the developer roller **120** and the metering blade **115**. In the illustrated embodiment, the cartridge **100** includes a driving gear **300** that may be rotated in the direction illustrated by arrow **305** in FIGS. **4** and **5** to back drive the developer roller **120**. The developer roller **120** may be back driven manually or with an appropriate tool by way of the driving gear **300**, by way of other gears, driving members, or rotatable components that may be provided on the cartridge **100**, or by direct engagement with the developer roller **120** itself.

As illustrated in FIGS. **4** and **6**, the developer roller **120** is rotated in the direction of the arrow **305** until the material **205** is moved to oppose the edge **132** of the metering blade **115**, such that the material **205** is located between the edge **132** of the metering blade **115** and the developer roller **120**. This also positions the band **138** such that a portion of the band **138** opposes the edge **132** of the metering blade **115**. With the material **205** positioned between the edge **132** of the metering blade **115** and the outer surface **136** of the developer roller **120**, the remanufactured toner cartridge **100** may be packaged and stored for prolonged periods with a reduced likelihood of print defects caused by material sticking to the developer roller **120**. Upon use by the end user, the relatively small amount of material **205** is typically removed from the developer roller during the initial startup procedure of the printer and has little or no effect on subsequent printing operations.

FIG. **7** is a flow-chart illustrating one exemplary process **400** for reducing image artifact in the toner cartridge **100**. Other embodiments of the process **400** may include more or less steps, including steps discussed above. The toner cartridge **100** is operated (Step **405**), for example by way of a post test, which positions toner particles **134** between the edge **132** of the metering blade **115** and the developer roller. The toner particles **134** are optionally removed from a portion of the developer roller **120** that is on the downstream side of the metering blade **115**, such as band **138** (Step **410**). Material **205** is applied to the portion of the developer roller **120** that is on the downstream side of the metering blade **115**, such as the band **138**, for example using a brush or swab (Step **415**). The material **205** is positioned between the edge **132** of the metering blade **115** and the developer roller **120** (Step **420**), for example by back-driving the developer roller **120** to position a portion of the band **138** in opposing relationship with the edge **132** of the metering blade.

Although the foregoing description refers to remanufactured toner cartridges **100**, the invention may also be applied to newly manufactured toner cartridges. Thus, the invention provides, among other things, an improved remanufactured toner cartridge, an improved toner cartridge, and an improved method for reducing image artifacts in remanufactured or newly manufactured toner cartridges. Various features and advantages of the invention are set forth in the following claims.

What is claimed is:

1. A method of reducing an image artifact during printing using a remanufactured toner cartridge, the method comprising:

post testing the remanufactured toner cartridge to transfer toner to a position between a developer roller and a metering blade of the remanufactured toner cartridge, the toner having a first formulation; and

positioning a material having a second formulation different from the first formulation between the developer roller and the metering blade.

2. The method of claim **1**, wherein positioning the material having the second formulation between the developer roller and the metering blade includes replacing the toner with the material.

3. The method of claim **1**, wherein the material having the second formulation includes a toner having a substantially yellow color.

4. The method of claim **1**, wherein the material having the second formulation includes a fluoroadditive.

5. The method of claim **1**, wherein the material having the second formulation includes a silicone resin.

6. The method of claim **1**, wherein positioning the material having the second formulation between the developer roller and the metering blade includes back-driving the developer roller.

7. The method of claim **1**, wherein positioning the material having the second formulation between the developer roller and the metering blade includes, after post testing the remanufactured toner cartridge, applying the material having the second formulation to a portion of the developer roller that is outside a toner hopper and on a first side of the metering blade.

8. The method of claim **7**, wherein positioning the material having the second formulation between the developer roller and the metering blade further includes back-driving the developer roller such that the portion of the developer roller with the material having the second formulation applied is moved to oppose an edge of the metering blade, the edge of the metering blade facing towards the developer roller.

9. The method of claim **7**, wherein positioning the material having the second formulation between the developer roller and the metering blade further includes removing toner from the portion of the developer roller before applying the material having the second formulation to the portion of the developer roller.

10. The method of claim **7**, wherein the toner comprises a first toner, and wherein the material having the second formulation comprises a second toner.

11. The method of claim **1**, wherein the toner comprises an aftermarket toner and the material having the second formulation comprises an original equipment manufacturer toner.

12. A remanufactured toner cartridge comprising:

a toner hopper;

a mass of toner stored within the toner hopper, the toner having a first formulation;

a developer roller supported for rotation by the toner hopper, the developer roller having an outer surface including a portion that faces into the toner hopper for gathering toner from the toner hopper;

a metering blade including an edge facing the developer roller, a first side facing into the toner hopper, and a second side facing away from the toner hopper; and

a material having a second formulation between the edge of the metering blade and the outer surface of the developer roller, the second formulation being different from the first formulation;

wherein the outer surface further includes a band that is outside the toner hopper and on the second side of the metering blade upon completion of a post test of the toner cartridge; and

wherein a portion of the band faces the edge of the metering blade upon completion of an operation following the post test.

13. The toner cartridge of claim **12**, wherein the material having the second formulation includes a toner having a substantially yellow color.

14. The toner cartridge of claim **12**, wherein the material having the second formulation includes a fluroadditive.

15. The toner cartridge of claim **12**, wherein the material having the second formulation includes a silicone resin.

16. The toner cartridge of claim **12**, wherein the mass of toner stored within the toner hopper comprises a first toner, and wherein the material having the second formulation comprises a second toner.

17. The toner cartridge of claim **12**, wherein the toner comprises an aftermarket toner and the material having the second formulation comprises an original equipment manufacturer toner.

18. The toner cartridge of claim **12**, wherein the material having the second formulation comprises an original equipment manufacturer yellow toner.

19. The toner cartridge of claim **12**, wherein the material having the second formulation is located between the edge of the metering blade and the portion of the band.

20. The toner cartridge of claim **12**, wherein the operation includes back-driving the developer roller.

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